

What is claimed is:

- 1 1. A sensor unit for sensing process parameters of a process to manufacture
2 an integrated circuit using integrated circuit processing equipment, the sensor unit
3 comprising:
4 a substrate having a wafer-shaped profile;
5 a first sensor, disposed on or in the substrate, to sample a first process
6 parameter; and
7 a second sensor, disposed on or in the substrate, to sample a second
8 process parameter wherein the second process parameter is different from the
9 first process parameter.
- 1 2. The sensor unit of claim 1 further including at least one battery, disposed
2 in the wafer-shaped substrate, to provide electrical power to the first sensor.
- 1 3. The sensor unit of claim 1 further including communications circuitry
2 disposed on the substrate, wherein the communications circuitry is coupled to the first
3 and second sensors to provide data to an external device wherein the data is
4 representative of the first and second process parameters.
- 1 4. The sensor unit of claim 1 further including a first source, disposed on or
2 in the substrate, wherein first source generates an interrogation signal and wherein the
3 first sensor uses the interrogation signal from the first source to sample the first process
4 parameter.

1 5. The sensor unit of claim 4 further including a second source, disposed on
2 or in the substrate, wherein second source generates an interrogation signal and
3 wherein the second sensor uses the interrogation signal from the second source to
4 sample the second process parameter.

1 6. The sensor unit of claim 4 wherein the first sensor and first source operate
2 in an end-point mode.

1 7. The sensor unit of claim 6 wherein the second sensor operates in a real-
2 time mode.

1 8. The sensor unit of claim 7 further including data storage to store data
2 which is representative of the second parameter.

1 9. The sensor unit of claim 7 wherein the sensor unit further includes:
2 data compression circuitry to compress the data which is representative of
3 the second parameter;
4 communication circuitry, coupled to the data compression circuitry, to
5 provide the data which is representative of the second parameter to external
6 circuitry; and
7 at least one rechargeable battery, to provide electrical power to the data
8 compression circuitry and the communication circuitry.

1 10. The sensor unit of claim 1 wherein the first sensor operates in a real-time
2 mode.

1 11. The sensor unit of claim 10 further including:
2 data storage to store data which is representative of the first parameter;
3 data compression circuitry to compress the data which is representative of
4 the first parameter;
5 communication circuitry, coupled to the data compression circuitry, to
6 provide the data which is representative of the first parameter to external
7 circuitry; and
8 at least one rechargeable battery, to provide electrical power to the data
9 compression circuitry and the communication circuitry.

1 12. The sensor unit of claim 10 wherein the first sensor samples the first
2 parameter periodically or continuously while the sensor unit is disposed in the integrated
3 circuit processing equipment and undergoing processing.

1 13. The sensor unit of claim 1 wherein the first sensor is a temperature sensor
2 and the second sensor is a pressure sensor.

1 14. The sensor unit of claim 1 wherein the first sensor is a temperature sensor
2 and the second sensor is a chemical sensor.

1 15. The sensor unit of claim 1 wherein the first sensor is a temperature sensor
2 and the second sensor is a surface tension sensor.

1 16. The sensor unit of claim 1 wherein the first sensor is a temperature sensor
2 and the second sensor is a surface stress sensor.

1 17. A sensor unit for sensing a first process parameter of a process to
2 manufacture an integrated circuit using integrated circuit processing equipment, the
3 sensor unit comprising:

4 a substrate having a wafer-shaped profile;

5 a source, disposed on or in the substrate, to generate an interrogation
6 signal; and

7 a first sensor, disposed on or in the substrate, to sample a first process
8 parameter using the interrogation signal from the source.

1 18. The sensor unit of claim 17 wherein the source and the first sensor
2 operate in an end-point mode.

1 19. The sensor unit of claim 17 wherein the source and the first sensor
2 operate in a real-time mode.

1 20. The sensor unit of claim 19 further including data storage to store data
2 which is representative of the first parameter.

1 21. The sensor unit of claim 19 wherein the sensor unit further includes:
2 data compression circuitry to compress the data which is representative of
3 the first parameter;
4 communication circuitry, coupled to the data compression circuitry, to
5 provide the data which is representative of the first parameter to external
6 circuitry; and
7 at least one rechargeable battery, to provide electrical power to the data
8 compression circuitry and the communication circuitry.

1 22. The sensor unit of claim 17 wherein the source is a VCSEL or LED.

1 23. The sensor unit of claim 22 wherein the first sensor is a CMOS devices,
2 charge coupled devices, or photodiode.

1 24. The sensor unit of claim 23 wherein the first parameter is the surface
2 profile.

1 25. The sensor unit of claim 23 wherein the sensor unit further includes a
2 predetermined surface layer which is disposed above the source and the first sensor.

1 26. The sensor unit of claim 25 wherein the predetermined surface layer is
2 comprised of a material that facilitates light propagation or scattering.

1 27. The sensor unit of claim 17 wherein the first sensor periodically or
2 continuously samples the first parameter while the sensor unit is disposed in the
3 integrated circuit processing equipment and undergoing processing.

1 28. The sensor unit of claim 27 further including data storage, coupled to the
2 first sensor, to store data which is representative of the first parameter.

1 29. The sensor unit of claim 27 wherein the sensor unit further includes:
2 communication circuitry, coupled to the data compression circuitry, to
3 provide the data which is representative of the first parameter to external
4 circuitry; and
5 at least one rechargeable battery, to provide electrical power to the data
6 compression circuitry and the communication circuitry.

1 30. The sensor unit of claim 29 wherein:
2 the source is a VCSEL or LED;
3 the first sensor is a CMOS devices, charge coupled devices, or
4 photodiode; and
5 wherein the sensor unit further includes a predetermined surface layer
6 which is disposed above the source and the first sensor.

1 31. The sensor unit of claim 30 wherein the first sensor samples the intensity
2 of reflected or scattered light.

1 32. The sensor unit of claim 31 further including a temperature sensor to
2 sample temperature, in a real-time mode, while the sensor unit is disposed in the
3 integrated circuit processing equipment and undergoing processing.

1 33. The sensor unit of claim 32 wherein the temperature sensor periodically or
2 continuously samples the temperature.

1 34. A sensor unit for sensing a first process parameter of a process to
2 manufacture an integrated circuit using integrated circuit processing equipment, the
3 sensor unit comprising:

4 a substrate having a wafer-shaped profile;

5 a first source, disposed on or in the substrate, to generate an interrogation
6 signal; and

7 a first sensor array including a plurality of first sensors disposed on or in
8 the substrate, wherein the first sensors sample a first process parameter using
9 the interrogation signal;

10 a second sensor array including a plurality of second sensors disposed on
11 or in the substrate, wherein the second sensors sample a second process
12 parameter wherein the second process parameter is different from the first
13 process parameter.

1 35. The sensor unit of claim 34 wherein the second sensors operate in a end-
2 point mode.

1 36. The sensor unit of claim 34 wherein the second sensors operate in a real-
2 time mode and sample the second process parameter continuously or periodically while
3 the sensor unit is disposed in the integrated circuit processing equipment and
4 undergoing processing.

1 37. The sensor unit of claim 34 wherein the first source and the first sensors
2 operate in an end-point mode.

1 38. The sensor unit of claim 34 wherein the first source and the first sensors
2 operate in a real-time mode.

1 39. The sensor unit of claim 38 further including:
2 data storage to store data sampled by the first sensors;
3 communication circuitry, coupled to the data storage, to provide the data
4 which is representative of the first parameter to external circuitry; and
5 at least one rechargeable battery, to provide electrical power to the first
6 source, the first sensors, the data storage and the communication circuitry.

1 40. The sensor unit of claim 38 wherein:
2 the first source is a VCSEL or LED;
3 the first sensor is a CMOS devices, charge coupled devices, or
4 photodiode; and

5 wherein the sensor unit further includes a predetermined surface layer
6 which is disposed above the first source and the first sensor.

1 41. The sensor unit of claim 40 wherein the first sensor samples the intensity
2 of reflected or scattered light.

1 42. The sensor unit of claim 41 wherein the second sensors are temperature
2 sensors.

1 43. The sensor unit of claim 42 wherein the temperature sensors sample
2 temperature, in a real-time mode, while the sensor unit is disposed in the integrated
3 circuit processing equipment and undergoing processing.

1 44. The sensor unit of claim 43 wherein the temperature sensors periodically
2 or continuously sample the temperature.

1 45. The sensor unit of claim 34 wherein the second sensors are pressure
2 sensors.

1 46. The sensor unit of claim 34 wherein the second sensors are light intensity
2 sensors.

1 47. The sensor unit of claim 34 wherein the second sensors are chemical
2 sensors.

1 48. The sensor unit of claim 34 wherein the second sensors are surface
2 tension sensors.

1 49. The sensor unit of claim 34 wherein the second sensors are surface stress
2 sensors.

1 50. The sensor unit of claim 34 wherein the second sensors are surface
2 profile sensors.